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U.S.S.R. COTTON AREAS AND ROUTE TRAVELED BY THE STUDY GROUP

U. S. DEPARTMENT OF AGRICULTURE

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Foreword

An Agreement, concluded on January 27, 1958, between the Governments of the United States of America and the Union of Soviet Socialist Republics, provides for exchanges in the cultural, technical, and educational fields during the years 1958 and 1959. This Agreement has been regarded as a significant first step in the improvement of mutual understanding between the peoples of the two countries.

Agriculture, which plays an important role in the national economies of the two countries, was specifically included in the Agreement as a field for exchange of specialists. The U. S. Department of Agriculture accordingly sent to the Soviet Union in 1958 six technical study groups of specialists in the following subjects: Agricultural Economics; Agricultural Crops, Soil and Water Use; Veterinary Science; Mechanization of Agriculture; Cotton Growing and Plant Physiology. In 1959 it is planned to send three additional study groups in the following fields: Forestry, Lumbering and Millwork; Sheep Raising; Biological Control of Agricultural Pests.

The Soviet Union in turn sent to the United States in 1958 six delegations of specialists in the following subjects: Farm Mechanization; Hydro-Engineering (Irrigation) and Reclamation; Animal Husbandry; Cotton Growing; Agricultural Construction and Electrification; Veterinary Science. In 1959 three additional Soviet teams are expected in the following fields: Mixed Feeds; Forestry, Lumbering and Millwork; Horticulture.

Each U.S. exchange study group, on completion of its assignment, prepared a report for publication. Cotton in the Soviet Union represents the report of the cotton exchange group and was prepared by Charles H. Barber, group leader and economist, Foreign Agricultural Service; Billy M. Waddle, plant breeder, Agricultural Research Service; Edward J. Overby, director of cotton marketing, Agricultural Marketing Service; William J. Martin, utilization specialist, Extension Service; Victor L. Stedronsky, ginning engineer, Agricultural Research Service; and Leonard A. Mobley, economist, National Cotton Council.



Gustave Burmeister
Assistant Administrator
Agricultural Trade Policy and Analysis
Foreign Agricultural Service

Contents

	Page
Summary	1
Production	3
Uzbekistan	3
Tadzhikistan.....	4
Azerbaydzhan	5
Research	5
Harvesting and quality evaluation	6
Ginning, drying, and cleaning equipment	7
Mill industry	10
Statistical appendix.....	12

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Cotton in the Soviet Union

Report of a Technical Study Group

Summary

A group of 6 U. S. cotton specialists and an interpreter arrived in Moscow the night of September 7, 1958, for a 32-day tour of the Soviet Union's cotton producing areas and mills. The 10,000-mile tour included visits to collective and state farms, gins, experiment stations, vocational schools, universities, and research institutions throughout most of the cotton growing areas. It also included visits to 5 cotton mills, 2 of them in Moscow and Leningrad, and a tour of the University of Moscow.

According to information from Soviet Government sources, available to us before we left Washington, and data obtained on the trip, the Soviet Union is growing about 7 million bales of cotton, all of it between latitudes 38° and 42° N. (Louisville, Ky., to Chicago). (The U.S. Cotton Belt is all south of 38° N.) Also, Russian mills consume about 5.3 million bales a year, and an additional 0.4 million bales (unspinnable qualities) are used in padding, upholstery, mattresses, litter for young farm animals, and so forth. Exports total about 1.5 million bales annually, with over 80 percent going to Eastern Europe and most of the remainder to Western Europe. Production was doubled in the decade 1948-58--to the 7 million bales, and the goal by 1965 is 5.7 million to 6.1 million metric tons of seed cotton--the equivalent of 9.0 million to 9.6 million bales of 500 pounds each. In production, consumption, and exports of cotton, the Soviet Union ranked second only to the United States prior to 1958, when China rose to second place in production and consumption.

Among the principal questions in our minds as we prepared for this trip were: How can cotton be grown on such a large scale in areas that far north? Can the goal of more than 9 million bales (about 30-percent increase) be reached by 1965? If the goal is reached, will the additional cotton and cotton textiles be absorbed in the domestic market or exported?

Production Area

The existence of a cotton-growing climate in the USSR north of 38° N. appears to be derived mainly from the fact that most of the cotton area is near sea level in a large desert basin (in central Asia) nearly surrounded by high mountains. Cloudless skies over the desert permit the sun rays to generate greater heat at the ground level. The

high daytime temperatures found here also prevail in other areas of the world, including the central part of North America, that are too far from large bodies of water to feel their moderating effect in summer. The principal differences between the topography of central Asia and that of central North America are the lower altitude of Russian cotton areas and the proximity of high mountains on three sides, which accounts for the lighter rainfall. Warm winds from the direction of the Indian Ocean and the Mediterranean Sea unload their moisture before rising over the mountains and become dry and warmer as they descend into the basin. The mountains are low on the north side of the basin, which results in low winter temperatures as the hard winds blow in from northern Siberia. Annual rainfall in the cotton areas is only 3 to 6 inches except in regions near the mountains, where 10 to 12 inches are reported.

More than 90 percent of the USSR's cotton is grown in this desert basin of central Asia within 300 miles of the northern borders of Afghanistan and Iran. All this cotton is irrigated. Water comes from five rivers fed by melting snows in the high Tien Shan and Pamir Mountains of Russia, Afghanistan, and Tibet. The water drains into the basin through desert valleys, which run east to west between ranges of barren mountains, a few of which have perennial snowcaps. Most of the remaining 7 or 8 percent of the USSR's cotton is grown a thousand miles to the west--in the Transcaucasus area, in a valley extending 250 miles west from Baku. This cotton is also irrigated.

Water in the USSR cotton areas is plentiful the year round and probably will not be a limiting factor in the cotton expansion program.

The concentration on cotton growing is so heavy in central Asia that it resembles the one-crop system existent in the U.S. Cotton Belt 30 years ago. Alfalfa needed for winter feed is the only commercial crop used for partial rotation with cotton except for small fields of melons and rice. Cultivable areas are seldom used as pasture even for rotation. Livestock consist mainly of sheep, goats, burros, and cattle (small numbers) tethered individually along the banks of irrigation ditches or tended by shepherds in rocky areas not suitable for cultivation. There are no fences along cotton fields or pasture areas.

The areas nearest the sources of water were developed first, resulting in a heavy concentration of cotton cultivation in the eastern portion of Uzbekistan. This Republic (equivalent to a U.S. State) accounts for two-

thirds of the Soviet crop. Plenty of new land appears to be available, mostly in Uzbekistan, Tadzhikistan, and Turkmenia, for the planned increase in the cotton area by 1965 of 1.2 million acres above the 1958 estimate of 5.2 million acres. However, it is a major undertaking to prepare this land with earth-moving equipment so irrigation water can be properly applied and proper drainage can be assured. The goal can be reached eventually but probably not by 1965.

Prime Minister Khrushchev, in a speech on December 15, 1958, before the 21st annual plenary session of the Central Committee of the Soviet Union Communist Party, discussed the 1965 production goal for cotton. He stated that production increases in the past had been achieved mainly by reclaiming new lands and constructing irrigation systems. He mentioned the high cost of this and of pumping stations and the settlement of workers in new areas. Land reclamation will be continued, he said, but efforts to increase production will be concentrated mainly on raising the yields per acre. Greater use of mechanized equipment, including mechanical pickers, was also mentioned as a necessary means of reducing the admittedly high cost of production.

Harvesting

At present, nearly all the cotton picking is done by women, although picking machines are said to be used for a quick finish of harvesting just before cold weather (with light rains) begins in November. Women do most of the manual labor on Russia's cotton farms, and farm labor appears to be ample. Workers are organized into groups of varying sizes up to 120, but most are composed of 45 to 60 workers. Each group works under a brigade leader, and each brigade is assigned about 2 acres of cotton per worker to tend.

After the cotton has been picked, it is usually spread out on highways or in other open places to dry for 4 or 5 hours before delivery to procurement centers or gins, and requires much manual labor in handling. This drying process is considered necessary to reduce the moisture content of the seed cotton before ginning or placing in storage; for cotton is usually picked as fast as the bolls open without waiting for the fiber to dry on the plant.

Ginning

During the harvest period, huge mounds of seed cotton, about 400 tons each, are built up at the gins, covered with tarpaulins, and gradually passed through the gins during the next 9 or 10 months. Better protection from winter weather is not essential because annual rainfall, practically all of it during November-

February, amounts to only 3 to 6 inches in most of central Asia and 12 to 15 inches in the Caucasus Peninsula.

Most of the ginning machinery is about like that in U.S. gins in the 1930's, and the speed of operation is too high for best results. Some new machinery and, in some instances, new gins have been installed in recent years. Present gins are fully used nearly all year, so expanded acreage will require new ones to handle the increased production. All presses at gins pack cotton at high density of about 32 pounds per cubic foot. Samples are taken before pressing, so bale covers are never cut for sampling. Bales are completely covered with cotton bagging or, at a lesser extent, with hessian cloth, and are tied with 10 strands of heavy wire.

Textiles

Cotton mills in the USSR are producing mostly cloth of medium quality in attractive colors but with a relatively narrow range of colors and patterns. Both the mill industry and cotton production are being gradually expanded but the rates of increase have diminished during the past 3 or 4 years. Most mills we observed were operating nearly 3 full shifts a day, but overall production of cotton goods and clothing appears to be far below what is needed for consumption in the Soviet Union.

Prices of cotton goods and wearing apparel are high in relation to wages and, in effect, provide an indirect system of rationing. Whether or not the additional cotton produced in coming years goes into domestic or export markets will depend mainly on government policy.

The Soviet Union, with its population of over 200 million, has only limited supplies of other natural fibers and no synthetic fiber industry of importance. Thus it could easily absorb all of the 2-million-bale planned increase in cotton production if the government decides to permit greater satisfaction of consumer needs. Reduction of consumer prices would be necessary to do this. We were told that all the expected increase in production will be consumed at home. In past years, however, both cotton and cotton goods have been exported regularly, either to generate foreign exchange needed for imports of industrial equipment and materials or to meet the terms of barter agreements with other countries mainly in Europe and the Middle East.

The rate and extent of expansion in cotton production, as in consumption, are mainly a matter of government policy in distribution of limited capital resources among the many projects for economic development of the country now under way. The potentials of land, labor, water, and domestic markets are present

for meeting planned cotton production and mill capacity goals when and if the necessary capital can be allocated to the cotton industry.

Observations on Farm Life

The income from collective farms is turned over to the heads of the farm for distribution after specified portions of the products are delivered to the government in lieu of rent and taxes. Various portions of the remainder are set aside in funds for operating costs, medical care, pensions, and entertainment of official guests. The workers are paid partly in grain and partly in cash, with the total based on the number of work-day units completed. Salaries and wages vary with the number of work units assigned to the job. One person may earn 2 or 3 work units for a day's work and others with less responsibility may earn 1 unit or less in a day. On state farms, workers are paid fixed wages per work unit, and they also are paid partly in cash and partly in food products as are the workers on collectives.

Apparently, then, not much cash gets into the hands of farm workers through this channel, but each family is permitted to retain the full proceeds from a small plot for a garden or orchard whether they use the products at home or sell them. Also, each family is permitted the full return from chickens, sheep, and other livestock when raised on a small scale. A number of food products of high quality are produced in substantial quantities in the cotton areas, but apparently little if any is shipped outside the area because of the great distances to potential markets and a need for refrigerator car service. The principal food crops and products observed are grapes, pomegranates, apples, quinces, figs, nuts, rice, potatoes, watermelons, other melons (similar to canteloupes), cucumbers, tomatoes, onions, milk, butter, eggs, mutton, and beef. Geese and ducks (domestic breeds) are numerous, especially geese, along the irrigation canals.

Practically all building materials except mud bricks must be hauled 1,000 miles or more for use in the desert area. As a result, most of the living quarters on the farms are adobe structures with thatched or sod roofs, but the walls of some are covered with stucco and painted for better weather protection. Farm workers usually live in villages, on farms of 5,000 to 10,000 acres, so there are no individual houses or cabins scattered around the farms. There are make-shift shelters in the large fields for midday rest and shade.

Workers are transported from village to field mostly by truck, but a large part of the transportation between farms and urban areas for people and light cargo is provided by burros as pack animals or hitched to carts. Most farm products are also moved by truck,

although we saw a few teams of horses and oxen and occasionally a camel. Draft power for farming is provided almost entirely by tractors.

Production

Cotton production in the Soviet Union, estimated at 7.0 million bales in 1958-59, has doubled in the past 10 years. The increase in acreage from 4.1 million acres in 1948-49 to 5.15 million in 1958-59 amounted to only 26 percent, but the average yield per acre rose from 398 pounds to 652 pounds. Significant improvements in yields from irrigated land no doubt were achieved during this period, but the sharp increase in the national average yield is attributed in large part to abandonment of cotton cultivation on about 2.5 million acres of dry land in European Russia where yields were very low while new areas in Asiatic Russia were being brought into production under irrigation.

Prior to 1955, most of the expansion in acreage and production occurred in the eastern half of the Republic of Uzbekistan. Other areas where significant expansion has taken place in recent years are in Tadzhikistan, Turkmenia, and Azerbaydzhan. Nearly all of the Egyptian-type cotton, estimated at 450,000 bales, produced in the Soviet Union is in Tadzhikistan (40 percent) and Turkmenia (40 percent). An additional 20 percent is grown in Uzbekistan and Kazakhstan. The producing areas we visited were all in Uzbekistan, Tadzhikistan, and Azerbaydzhan, which together account for about 85 percent of cotton production in the Soviet Union.

Uzbekistan

The Republic of Uzbekistan extends more than 1,100 miles through the heart of the central Asian desert, from the Afghanistan border northwestward to the Aral Sea. Apparently a very large supply of water is available to the irrigated areas of this Republic. We were in Uzbekistan at the time of the lowest water run-off. Even at that time, all irrigation canals were full, and the rivers had a considerable amount of water which, if not used for irrigation, runs into the Aral Sea. At no time was there any indication by the farming groups, Ministry officials, or research personnel that there was any concern whatsoever about the adequacy of water availability for the present agricultural needs or for future planned expansion.

Observations of reclamation projects were restricted to one field visit and numerous observations during plane flights. Judging from aerial observations, there are tens of thousands of acres of desert land that can be leveled and adapted to irrigation agriculture.

Much of the new land is moderately to highly saline but the problem of salinity can be and is being overcome by leaching. Yields were admittedly very low during the first 2 or 3 years of cultivation of new land because of high salinity. The water supply is apparently quite low in total salts. In certain areas, drainage problems exist, but this difficulty is being overcome by the common use of drainage canals. This is particularly true of the lands lying along the river plains.

Nearly all Uzbekistan cotton is of American upland type. The yield estimate of 23.1 centners per hectare of seed cotton (about 700 pounds of lint per acre) for the Republic this year would appear to be fairly accurate based on the observations made on the collective and state farms we visited. There was considerable 2-bale-per-acre cotton, and occasionally even better yields were indicated. Also there was cotton that would not produce more than a bale per acre. The expected yields quoted by the collective farm agronomists or chairman for given fields, however, were usually slightly higher than estimated by members of the U.S. team.

The manpower of Uzbekistan--and throughout the areas of the USSR we visited--appeared to be virtually unlimited. The labor force is composed mostly of women, and is short of men between ages 35 and 50. This was evident in all areas, and is probably due in part to the high casualty rate of World War II and to current military service requirements. The use of man-power would seem to be such as to indicate surplus labor in many instances, since there was constant evidence of people doing what appeared to us as minor or completely unnecessary jobs just to be busy.

The hand-picked, wind- and sun-dried seed cotton seen throughout the Republic was of such good grade, owing to lack of trash, that the current crop should produce a substantial percentage of high-grade cotton, particularly from that part of the 1958 production harvested prior to frost. However, rough preparation due to improper ginning is a common cause of some reduction in quality.

The appearance in general of the cotton plants throughout the Republic indicated that an adequate fertilizer program is being followed. The cotton was usually under 3 feet in height, of a semicluster fruiting habit, with large bolls and very good yield. There was almost no evidence of nutrient deficiency, and for the most part the plants were well developed and fruited. In addition to the inorganic fertilizers, particularly nitrogen, that are used, we were told that approximately 10 tons of barnyard manure per hectare (2.47 acres) is generally applied.

The fields of Uzbekistan were fairly clean, although we saw a few that were weedy. Most of the weeding had been done by hand, although considerable claim is made for the merits of

check-row planting and cross cultivation. This method of cultivation is possible only when the plants are small and it hinders the even flow of irrigation water. Cross cultivation would tend to reduce the hand-weeding requirements. In addition, the close spacing recommended by the agronomists, usually 45 centimeters (about 18 inches) between rows and 45 centimeters between hills would give a high population of plants per unit of land. The common weeds observed--which seem to be giving the most trouble--were Johnsongrass, pigweed, bindweed, and Bermudagrass.

There is said to be no problem in the seed maintenance program; however, at least 50 percent of the fields observed had obvious seed mixtures as evidenced by off-type and hybrid plants. In many instances the hybrids appeared to have Asiatic characteristics. Observations of the ginning equipment and of the methods used to handle the seed cotton indicated that there would be ample opportunity for mixture of seed during the movement of seed cotton from the field through the gins.

Perhaps the greatest potential problem for cotton production in Uzbekistan is the threat of wide-spread verticillium wilt damage. This disease exists in most of the Republic and in many areas it is common. The cool nights during the growing season and the frequent irrigations undoubtedly enhance the conditions that cause the spread and virulence of the disease. There is also some fusarium wilt, and the growers and research people appear to be confused about which wilt is being dealt with in specific cases. As root-knot nematode is said not to exist in the Republic, there is some doubt as to how much fusarium is present.

The Republic of Uzbekistan, with its almost unlimited water supply, large areas of land that can be reclaimed, surplus labor force, and good ambitious farm management, has great potential for production of cotton as well as for any other crops that lend themselves to irrigation agriculture.

Tadzhikistan

The Republic of Tadzhikistan lies just north of Afghanistan and is one of the major producing areas of extra-long staple cotton in the USSR.

The yields of this type of cotton that we saw were generally good and near the 1-bale-per-acre yield level.

The plant type of the long staple varieties was very poor as judged by Pima S-1 standards. The fruiting habit was of the cluster type, bolls were small, and the plants were weak stemmed and very leafy.

The obvious seed mixtures in all fields were even more striking than in the upland cotton in Uzbekistan.

A leaf spot disease, identified as *macrosporium*, was common to most of the fields observed. However, the chances are good that this disease was actually *cercospora* leaf spot.

The fields in general were not leveled as well as those in Uzbekistan. The soil is of considerably coarser texture and better adapted to the growth of *Barbadense* cotton. The climate is also somewhat more suitable for *Barbadense* than that of Uzbekistan.

The gins observed were of the saw type and were being used to gin long staple cotton as well as upland type. Naturally, there was considerable damage being done to the longer staple fiber. Some roller-ginned bales were observed in mills.

The insect damage in Tadzhikistan, as well as in Uzbekistan, is caused by bollworms, spider mites, asphids, and cutworms.

Azerbaydzhan

The cotton producing areas of this Republic lie in a broad valley between the Little and Great Caucasus Mountain ranges in the Transcaucasus. At the end of September when the delegation visited this production area, the rainy season had apparently begun (light rains) at about the same time as harvest and it was obvious that the average grades of this crop would be low.

The plant type of the cotton grown is not of the semicluster nature observed in the other Republics but is of a more open type and not as high yielding.

Insect problems are apparently serious, and in 1958 there was a heavy infestation of cotton bollworm. One field had 10 applications of calcium arsenate; still the loss was estimated at 25 percent of the crop. Other fields had had heavy spider mite attacks. It is in this Republic that the close relative of the pink bollworm, *Pectinophora malvella*, is said to be a serious problem. However, this insect or its damage was not observed.

The yields were somewhat lower than those we observed in Uzbekistan and Tadzhikistan. Grades were lower because of weathering damage.

Irrigation water is also plentiful in this area. Rainfall, 10 to 15 inches annually, is about double that of Uzbekistan's cotton areas 1,000 miles to the east, but little of it occurs during the cotton growing period. The climate apparently is such that other crops would be better adapted than cotton, and it would not be surprising if cotton production eventually disappears from this part of the USSR.

Research

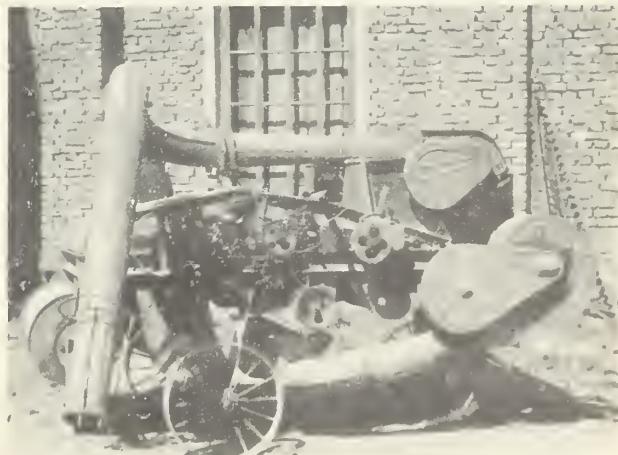
In the five field experiment stations we visited, quality of the work being conducted was, in general, very good, we felt. The



This man heads one of the largest cotton collectives in Uzbekistan, principal USSR cotton area. Nearly all Soviet cotton is grown on this white desert soil under irrigation.



Cotton spread on the road to dry is a common sight in much of the Soviet cotton producing area, for it is picked as soon as the bolls open, and before the fiber has dried.



Portable machine for cracking immature bolls, used at procurement centers, where cotton is collected and taken to gins.



U.S. technical study group inspects field of Egyptian-type cotton ready for harvest, Tadzhikistan. This type makes up only about 6 percent of total cotton production in the USSR.

emphasis is on applied rather than fundamental research. Cotton physiology and breeding research is handled by competent, well-trained research scientists who are using conventional methods in their program.

The agronomic research on cotton culture methodology is probably the best of all the research activities and has resulted in farming practices which are very good in most areas we visited. Pathology was felt to be the poorest of all the research fields observed. Entomology is getting considerable attention at this time. The recommendations coming out of the research program are being well followed on the collective and state farms. There are exceptions, such as the general practice of late-season irrigation, which is contrary to research scientists' recommendations.

Discussions with the leaders at the Plant Breeding Research Institute and the Plant Protection Institute in Leningrad resulted in the feeling that the leaders in plant research are of the highest caliber. Library facilities are excellent, and the workers have a thorough knowledge of the literature in their respective fields. The exchange of ideas and results at these institutes was a stimulating experience. We felt that the quality and quantity of the research undertakings in the field of cotton production in the USSR are good and are producing desired results for the applied phase of cotton production. However, there was little evidence of real emphasis on fundamental research, and it is felt that this could be detrimental to the long-range goals.

Harvesting and Quality Evaluation

About the most difficult subject on which we tried to obtain information in the Soviet Union was the system of quality evaluation of cotton

and the basis for transactions between farmers, gingers, and mills. On most subjects the Soviets were cooperative and showed us their operating tools and methods, but on quality evaluation it was most difficult to get any precise information at the gins and field stations, where most of the work is done. This difficulty may have stemmed somewhat from the system used; it requires little real understanding of principles involved by the operators at the gins.

Cotton is evaluated at the first processing plant--the gin--and this evaluation generally stays with the cotton to its final destination.

Each ginnery has a fiber evaluation laboratory with instruments for determining the strength and grade of the ginned lint. Periodic sampling is done before the cotton is pressed. The gin establishes the quality of the baled cotton, and shipments are made to spinning mills on the quality certificates that are issued by the gins. This is a rather significant thing in that it should make the gin operators highly conscious of grade quality because the mills expect the cotton to be of the quality certified at the gins. Any dispute pertaining to the fiber quality is settled by arbitration through a state inspector. Apparently the mills still have to use the cotton that is delivered to them, but if the arbitrator decides in favor of the mill, a price adjustment is made. The periodic sampling of the bales at the gin is sufficient since the seed cotton is graded prior to ginning and stored according to grade either at the procurement station or in the gin yard.

Sorting for uniformity starts with picking. Cotton produced in an area is generally of one variety and thus quite uniform in basic properties. Also, it is sorted as seed cotton when it is first picked. Pickers use a separate container for hard locks and other off-grade bolls or locks. Seed cotton is brought to the

ends of the rows where several piles are made which give the first sorting by quality, based largely on trash content and damaged bolls apparent at this stage.

From the fields, cotton is sacked by "sorts" and hauled to a procurement center. There are many procurement centers in the gin's territory--a territory which may be as large as 25 miles in radius from the gin and contain up to 25 procurement centers. At the centers, cotton is spread out in thin layers on a concrete, adobe, or macadam yard. For several hours it is left in the sun, and laborers constantly rake or fork it. While this process may be detrimental to staple, it is certainly a device which tends to improve grade and results in a blended uniformity of cotton going to the gin. At the procurement centers, portable field cleaners are used when necessary.

From the procurement centers the cotton is sacked and hauled to the ginning yard. At this point, cotton is passed through cleaners, extractors, and drum dryers, when cleaning and further drying are considered necessary. It then goes directly to the gin or into storage in the gin yard to await ginning. There we found what was to us an interesting phenomenon: Seed cotton piled in great stacks some 40-50 feet long and 25 feet wide. Conveyors build the stacks to a height of 15-20 feet. These piles usually contain around 400 to 500 tons of seed cotton. The cotton is stacked on raised rock or concrete platforms and provision is made for ventilating the stacks if necessary to prevent heating. With this system the ginning season is extended to cover 9-10 months of the year.

Evaluation is done after the first sorting by visual inspection. This system is based on laboratory techniques developed and standardized in the Central Research Bureau in Moscow. The central laboratory is well staffed with professional people and has adequate equipment. The grading system is based heavily on maturity of fiber as determined by inspection under a polarized light microscope. In the central laboratory, workers have made large numbers of tests on cotton sorted into grades by this process and developed coefficients for maturity, fineness, and strength which are "usually" associated with each of the grades. There is even an attempt to relate length to grade determinations, and such coefficients have been developed but are not yet considered reliable. Such coefficients, of course, have to be developed for each variety of cotton. The cotton has a great deal of uniformity in quality resulting from the way it is grown and handled. As a result, this system, which would hardly satisfy evaluation needs in the United States, provides a basis that seems to serve the needs.

It appeared that laboratory techniques necessary to measure most fiber properties are known and available for use in plant breeding

and other experimental work. It is believed that actual measurements may also be made on some or all cotton going into export. However, for the bulk of the crop which moves from gin to spinning mill in the USSR there seems to be a simplified short-cut method in use. This consists of merely inspecting cotton in the gin laboratory under a polarized light microscope and comparing this view with the colored grade charts published in the handbook used by all laboratories for this purpose. After the grade is determined, the coefficients related to the grade for other factors of fineness, maturity, strength, etc., are taken from the proper table. Some tests are made for length on the Zhukov sorter and for strength on the dynamometer, but these do not seem to be used generally.

In testing, only 5 to 10 percent of the bales in a lot are tested. Also, length is not given the same consideration as in the United States. These points are a result of the cotton's being produced and handled uniformly, and the Soviets apparently feel that tests on more bales are unnecessary.

According to U.S. concepts for measuring fiber lengths, the Russians seem to overstate length by approximately one-sixteenth inch.

While we were not impressed by the methods of grading and evaluating insofar as U.S. customs are concerned, it must be repeated that theirs is a system that works relatively well in meeting their requirements. All measurements are made in an objective manner; there is no pressure by buyer or seller interests which might encourage greater precision. When a dispute occurs on quality, a person from the Central Bureau looks at the cotton and tests a portion of it. If it is below the labeled grade a settlement is allowed, but the mill must keep the cotton.

Ginning, Drying, and Cleaning Equipment

The team visited five cotton gins during its tour and was able to obtain other information pertaining to the ginning of cotton from GOSPLAN (the State Planning Commission), conferences with cotton ginning laboratory technicians, and other sources. All of the gins we observed were of the saw-type, and most of the cotton grown in the Soviet Union is of American upland type. The crop includes 450,000 to 500,000 bales of long staple, fine-fibered cotton (corresponding to our American-Egyptian type), but we saw no roller gins in the areas growing this cotton. Apparently some are in operation because a small amount of roller-ginned Egyptian type cotton was seen at mills. The only roller gin stand seen was on exhibition at the All Union Exposition in Moscow. However, it is possible that some are in the Turkmen Republic, which we did not visit. Of particular interest is the fact

that the extra-long staple cotton grown in Vaksh Valley is saw-ginned. We were told that some roller gins were in operation and that saw-gin equipment for this type cotton would all eventually be replaced. The saw-ginning of this cotton is undoubtedly done with some loss of staple length, rougher preparation, and increased nepiness.

In general, the cotton ginning machinery in the Soviet Union is of much simpler designs and is far from the stage of development that is considered standard in the United States. Also, the cotton drying, cleaning, and extracting machinery is of rather simple design and would be considered obsolete in our modern cotton gins, but it seems to be adequate and serves its purpose under the USSR's production and harvesting practices. More elaborate machinery, normally found in U.S. gins, is not needed under the harvesting practices which we observed. Most of the cotton is carefully hand picked but machine pickers are used for late-season harvesting. The seed cotton is spread out at the end of cotton rows and on highways and other prepared open areas and is stirred almost continuously with pitch forks for 4 or 5 hours. It is then hauled to the procurement stations in trucks or in some instances in horse or ox-drawn wagons. These practices do simplify the ginning problems. Some of the procurement stations are at the gin yards; others receive the cotton in outlying areas, sort and handle it as needed before it is hauled to the gins.

According to GOSPLAN, there are approximately 120 ginning plants in the USSR with an average of 5 gin stands per plant, or a total of 600 gin stands. Apparently, the country has just enough ginning facilities to gin the crop by operating almost on a year-round basis. These ginneries gin large volumes of cotton averaging about 60,000 bales annually per gin of 5 stands. The ginneries are located in strategic places where each one receives cotton from several procurement stations. The ginning establishments in general seem to be built on a set pattern, for all the gins visited were practically identical.

Each ginnery consisted of 3 separate installations. The first is called the drying section and had 2 or 3 driers for conditioning the cotton if needed. Each of the seed cotton driers observed consisted of a machine approximately 12 feet in diameter up to about 40 feet long, inside of which was a large revolving screen drum. Cotton was injected at one end of the drier and the tumbling action permitted it to be discharged at the opposite end. Temperature of the air and the time of exposure are regulated so as to control the amount of drying required, depending on the moisture content of the seed cotton. This is a highly satisfactory cotton drying process.

Each ginnery also has a separate installation for cleaning and extracting. The cotton can be delivered continuously to this section from the driers or separately if drying is not required. The cleaning units are of rather simple design and probably do not have a very high cleaning efficiency, but under their clean harvesting practices little foreign matter removal is required. From the cleaning section the cotton goes into large storage piles or is delivered direct to the gin stands.

The ginning section has only a small amount of equipment and according to U.S. standards would be classified as a simple ginning plant. Usually the gin consists of only a 4-cylinder cleaner which delivers the seed cotton to a distributor, and then to the feeders over the gin stands. The cleaning feeders are not capable of any extracting or rough foreign matter removal. They take out small leaf particles only. Their main function is to regulate the flow of cotton into the gin stand.

The gin stands were of simple design, being single rib with airblast doffing. Those observed were 80-saw size, having saw diameters of about 12-1/2 inches, whereas 12-inch-diameter saws are standard in the United States. Saw speeds of 720 r.p.m. are comparable with those of American gins. The roll boxes seemed to be considerably larger than is customary on U.S. gins. Ginning capacity of USSR gins based on lint ginned per saw per hour ranges from 14 to 18 pounds, whereas 8 to 10 is customary in U.S. gins. This does not imply that the Soviet design is better or that the gin stands are faster. The Soviets employ techniques which we do not consider good practice, such as ginning with a very tight seed roll, which means that the gin stands were being crowded and forced to gin more cotton than is considered a normal rate of ginning. This in turn results in the rough preparation evident in most of the ginned cotton observed. Apparently 4 stands per plant is the normal size although we did see one 3-stand gin.

The pressing and packaging operations at these gins are good. The presses are capable of pressing the bale to a density of about 32 pounds per cubic foot. The package is neat and is not mutilated by sampling. Generally, 10-wire ties of approximately 5/32-inch diameter were used instead of bands for tying out the bales. Cotton bagging is commonly used for bale coverings, although some of the gins use hessian cloth. The bales are completely covered and the heads are sewed.

The delinting of seed is a part of the ginning operation in the Soviet Union. (In the United States it is part of the oil mill process.) Seed are delivered direct from the gin stands to delinters, which are usually in the same



Above, huge mounds of seed cotton piled at Soviet gins at harvest. It is then processed over the next 9-10 months. Left, suction pipes take cotton from gin yard to gin, Tadzhikistan.

Cotton bales are covered with cotton bagging in Soviet Russia and tied with 10 strands of heavy wire. Below, bale press in Uzbekistan. Bales are pressed to high density at all gins.



room or building with the gin stands. Four to five delinters per gin stand are required to keep up with the gins. The delinters appear to be similar to those commonly used in U.S. cotton oil mills except that the Soviets employ airblast doffing, whereas most of the delinters in this country use brush doffing. Apparently the Russian delinted seed are then delivered from the ginnery to their cotton oil mills.

Cotton Textile Industry¹

At the first meetings in Moscow, we learned that the textile industry does not come within the province of the Ministry of Agriculture. The USSR State Planning Commission, GOSPLAN, exercises overall control. Representatives told us that it is responsible for cotton distribution to the mills and that the staff includes specialists on all types of fibers. GOSPLAN controls the movement of cotton from the time it reaches the procurement stations as seed cotton, where the farms relinquish control, all the way through until it is bought by the consumer as yarn or fabric or is exported.

The Russian textile industry relies primarily on natural fibers for its raw materials. Cotton makes up nearly 70 percent, and flax, wool, man-made fiber, and silk make up the remainder. Spinning mills consumed about 5.2 million bales of cotton in 1958. Quantities of unspinnable qualities used for other purposes are estimated at 0.3 to 0.4 million bales annually.

Production of fabrics from the apparel-type fiber or yarn amounted to 7.1 billion meters (1 meter equals 1.1 yards) in 1957, according to the figures supplied by GOSPLAN. Cotton accounted for 78.7 percent of the cloth; wool, 4.0 percent; linen, 6.0 percent; man-made fiber, 6.5 percent, and silk, 4.8 percent.

The cotton textile industry is believed to be operating below capacity. Production of cotton yarn in 1957 was reported at 1,016,000 metric tons, slightly below the 1955 estimate of 1,038,000. At the same time, there has been some increase in capacity, with 1957 reported at 10,147,000 spindles as compared with 10 million in 1955. GOSPLAN officials and some mill executives reported that shortages of raw materials were a restricting factor in cotton mill activity. In the few mills visited, the industry was found to be in various stages of efficiency from a competitive point of view. Much of the machinery is old, and new machinery appeared to be coming in slowly. Some very good machinery was on display at the Exposition in Moscow,

but we did not see much of it in actual operation in the mills visited.

There appeared to be plenty of labor available for the industry. Women comprised 70 to 80 percent of the total force at the various plants visited. Work loads were stated to be generally in line with those in the United States, but quite a number of people were seen in the plants doing rather minor jobs. Women were performing all sorts of operations, even heavy work customarily done by men in U.S. mills. Most of the men were involved in construction work or some of the heavier maintenance.

Since there is no real economic competition, as we think of it, among the various mills, most of the competition stems from production volume. Quality comes in for some minor consideration; it is of minor importance because of the shortage of materials available to the population. Mills are somewhat concerned about the quality of the raw cotton they get, but they have to use what is furnished, and turn out as good a product in maximum quantity as they can. Since they have little responsibility for the product after it leaves the plant, they have no strong incentive to be concerned about anything more than meeting minimum standards. Prices are fixed by the state and at no stage of the cotton economy did we find much concern over the relationship of quality and price.

At the mills, there was also little concern over methods of amortization for machinery. Apparently since all machinery belonged to the state, responsibility for replacing it when worn out is the state's. Otherwise, the mill has to make repairs and operate with it the best it can. At the final meeting in Moscow, we were told that mill machinery is amortized over 10 to 20 years, but it is used longer if it is not worn out by that time.

Everywhere, there is a strong feeling of what will be done in the future and much talk about becoming the No. 1 cotton textile nation by 1965. It is evident from the expansion plans of some of the mills we visited and from the planned construction as shown on a map in the cotton pavilion at the Moscow Exposition that a considerable increase in capacity is now under way or scheduled for the near future. It is entirely possible, however, that even after the textiles are produced, domestic consumption will be restricted by high prices as it is now, for the purpose of expanding exports of yarns and fabrics.

The industry is currently operating below capacity, with domestic consumption of cloth restricted by high retail prices, while exports of cotton are averaging about 1.5 million bales annually. The continuation of such policies could result in rather large quantities of raw cotton being freed for export even though the industry had unused capacity, and in spite of a genuine need for more textiles by the Russian people.

¹ More detailed information on the visits to individual mills is available on request to the Division of Information, FAS, U.S.D.A.

GOSPLAN officials were not at liberty to give precise figures on the 1965 goals for textile capacity and cotton consumption. However, they indicated that capacity expansion was planned at about the same magnitude as

that for cotton production, or between 45 and 50 percent. When the 1965 plan is published, it will provide a source for more accurate information on mill expansion.

Statistical Appendix

Explanatory Notes

Russian cotton trade statistics presented in tables 1 and 2 appear to be complete for calendar years 1947 through 1957 and are accepted as reasonably accurate.

Cotton consumption figures are not reported for the country as a whole. The only basis for estimating mill consumption are cotton yarn production figures (table 3). The percentage of waste (7 to 9 percent) applicable is available for most of these years so that reasonably accurate figures for cotton consumed by spinning mills may be computed. However, there are no estimates or bases for computing figures for the fairly large amount of cotton used each year in padding (especially for winter clothing), mattresses, upholstery, sanitary purposes, etc. Since most of this cotton consists of unspinnable fiber extracted from immature bolls gathered after the stalks are killed by frost, it probably equals 4 to 7 percent of the previous year's crop depending mainly on the size of the crop and the date of the first killing frost.

Cotton acreage figures (table 4) appear to be reasonably accurate except possibly for the nonirrigated areas where cotton growing

reached a peak of about 2,450,000 acres in 1952 and has been almost completely abandoned in recent years. The growing seasons were too erratic, irrigation is not available, and yields were extremely low.

The most incomplete and inconsistent cotton statistics (except for nonexistent stock figures) are those on production. Prior to Premier Stalin's death in 1953, the production figures admittedly related to "cotton produced" whether or not all of it matured and was harvested. A complete series of estimates, by Republics, is not available. Those reported for the country as a whole are generally higher than the ginnings, reported on a calendar year basis by the Central Statistical Bureau and do not conform to the supply and disappearance in most years as indicated by trade and yarn production figures. Ginnings (table 5) are probably a more accurate indication of the level of production, but are reported on a calendar year basis, although ginning begins in September and is finished 9 to 10 months later.

No end-season cotton stock figures are available, but the delegation was told that they usually equal 2 to 3 months' mill requirements.

Addendum to Statistical Appendix of
 COTTON IN THE SOVIET UNION
 Report of a Technical Study Group

Page 13. Table 1---Exports of USSR cotton by country
 of destination, average 1955-59, annual 1960-61

(Bales of 500 pounds gross)				
Country	Calendar years			
	Average	1960	1961	
	1955-59			
Albania.....	3,766:	0:		0
Bulgaria.....	44,000:	82,673:	84,510	
China, Mainland.....	9,276:	0:		0
Czechoslovakia.....	214,122:	227,809:	272,819	
Germany, East.....	371,291:	396,369:	382,131	
Hungary.....	136,410:	177,746:	161,671	
Poland & Danzig.....	294,498:	352,736:	343,550	
Rumania.....	138,706:	142,840:	133,654	
Total Communist.....	1,212,069:	1,380,173:	1,378,335	
Austria.....	14,422:	22,505:	24,342	
Belgium & Luxembourg.....	6,798:	0:		0
Canada.....	92:	0:		0
Cuba.....	0:	13,779:	68,894	
Finland.....	46,021:	58,789:	42,255	
France.....	31,324:	45,929:	24,802	
Germany, West.....	50,063:	93,696:	37,662	
India.....	276:	0:		0
Italy.....	18,188:	57,871:	45,929	
Japan.....	4,409:	46,848:	38,121	
Korea, North.....	10,013:	9,186:	45,929	
Netherlands.....	5,144:	0:		0
Norway.....	92:	0:		0
Portugal.....	1,745:	0:		0
Sweden.....	1,562:	0:		0
Switzerland.....	2,480:	0:		0
United Kingdom.....	47,858:	45,929:	39,499	
United States.....	92:	0:		0
Uruguay.....	4,593:	0:		0
Vietnam.....	919:	0:		0
Yugoslavia.....	30,405:	4,593:	0	
(Others (i.e. iSolide China))	0:	16,533:	11,482	
Total non-Communist.....	276,496:	415,658:	378,915	
Total all countries.....	1,488,565:	1,795,831:	1,757,250	

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Addendum to Statistical Appendix of
 COTTON IN THE SOVIET UNION
 Report of a Technical Study Group

Page 14. Table 2.--Imports of cotton, USSR, by country of origin, average 1955-59, annual 1960-61

Country of origin	(Bales of 500 pounds gross)		
	Calendar years		
	Average	1960	1961
	1955-59	1960	1961
Albania.....	1,562	0	0
Bulgaria.....	1,102	0	0
China, Mainland.....	65,679	215,408	0
Total Communist.....	68,343	215,408	0
Afghanistan.....	31,599	27,098	32,150
Brazil.....	0	0	28,017
Egypt.....	331,608	510,273	421,630
Greece.....	4,226	9,186	12,860
Iran.....	21,036	39,499	33,069
Iraq.....	2,021	0	0
Mexico.....	0	13,320	0
Pakistan.....	4,317	0	0
Sudan.....	7,624	24,802	45,470
Syria.....	1/	47,766	22,505
United States.....	0	0	0
Others (May include China).....	0	0	54,656
Total non-Communist.....	402,431	671,944	650,357
Total all countries.....	470,774	887,352	650,357

1/ Syria included with Egypt.

Foreign Agricultural Service
 United States Department of Agriculture

June 1962

TABLE 1.--Exports of USSR cotton by country of destination, calendar years 1947-57¹

Country	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957
Austria.....	Bales ² 1,378	Bales ² 0									
Albania.....	0	0	0	0	0	0	0	0	0	11,023	17,912
United Kingdom.....	38,581	919	52,819	66,138	43,173	52,819	42,714	64,760	8,267	1,378	5,512
Belgium.....	459	0	0	0	0	0	0	5,511	100,585	45,011	7,349
Bulgaria.....	62,464	52,819	129,520	138,706	140,084	156,159	158,915	182,798	22,046	7,808	24,342
Hungary.....	43,173	46,848	67,057	67,537	223,216	295,325	311,400	348,602	31,691	20,209	48,685
Germany, East.....	99,207	36,743	0	0	0	0	0	7,349	19,750	109,311	141,462
Netherlands.....	0	0	0	0	0	0	0	0	19,290	378,456	349,521
Denmark.....	9,186	0	0	0	0	0	0	0	5,052	919	459
Italy.....	0	0	0	0	0	0	0	0	0	0	0
Norway.....	0	0	0	0	0	0	0	0	56,493	19,290	5,971
Poland.....	174,531	304,051	266,389	355,492	318,289	317,830	296,243	360,544	315,074	301,755	318,748
Romania.....	78,080	103,341	136,410	144,677	163,967	161,211	130,439	134,113	133,195	138,706	131,817
Germany, West.....	0	0	0	0	0	0	0	0	0	459	0
Finland.....	0	0	0	0	0	0	0	0	0	0	0
France.....	0	0	0	0	0	0	0	0	0	0	0
Czech.....	23,424	145,595	131,357	141,921	134,572	184,635	190,147	208,518	191,065	201,170	223,216
Switzerland.....	0	0	0	0	0	0	21,387	14,238	0	0	0
Sweden.....	459	0	0	0	0	0	0	2,756	7,808	0	0
Yugoslavia.....	57,871	62,464	0	0	0	0	0	4,593	29,395	34,906	55,115
India.....	0	0	0	0	0	0	0	0	1,378	0	0
China.....	38,580	78,998	83,132	9,645	47,307	0	0	64,760	46,388	0	0
Korea, North.....	0	14,697	0	0	0	0	0	0	0	0	23,424
United States.....	8,267	0	0	0	0	0	0	3,674	919	459	0
Uruguay.....	0	0	0	0	0	0	0	0	0	12,401	0
Japan.....	0	0	0	0	0	0	0	0	459	0	0
Total.....	635,660	846,475	880,003	991,151	1,080,254	1,162,467	1,239,169	1,596,498	1,547,354	1,421,508	1,463,763

¹ Reported to the International Cotton Advisory Committee by the Soviet Government.

² In bales of 500 lbs. gross weight.

Compiled by Cotton Division, FAS.

TABLE 2.--Imports of cotton, USSR, by country of origin, calendar years 1947-57¹

Country	1947	1948	1949	1950	1951	1952
Albania.....	Bales ² 0	Bales ² 0	Bales ² 3,674	Bales ² 1,378	Bales ² 1,378	Bales ² 0
Afghanistan.....	0	0	0	0	15,157	4,134
Bulgaria.....	0	0	0	0	0	0
Brazil.....	0	41,336	0	0	0	0
Greece.....	0	0	0	0	0	0
Egypt.....	0	209,896	192,443	125,846	0	91,858
Iran.....	0	0	0	0	2,296	17,912
China.....	0	0	0	0	0	0
Pakistan.....	0	152,944	53,278	42,255	0	44,092
Syria.....	0	0	0	0	0	0
U.S.A.....	0	83,132	142,381	37,202	0	0
Total.....	0	487,308	391,776	206,681	18,831	157,996

Country	1953	1954	1955	1956	1957
Albania.....	Bales ² 459	Bales ² 919	Bales ² 0	Bales ² 4,134	Bales ² 3,674
Afghanistan.....	15,157	16,534	18,831	39,958	61,086
Bulgaria.....	0	0	5,511	0	0
Sudan.....	0	0	0	0	9,186
Greece.....	0	0	0	2,756	0
Egypt.....	52,359	39,499	47,307	174,531	374,782
Iran.....	6,430	16,075	19,750	5,511	15,616
China.....	2,296	0	0	0	0
Pakistan.....	16,535	0	0	4,593	10,104
Syria.....	0	0	0	4,593	25,261
U.S.A.....	0	0	0	0	0
Total.....	93,236	73,027	91,399	236,076	499,709

¹ Reported to the International Cotton Advisory Committee by the Soviet Government.² In bales of 500 lbs. gross weight.

Compiled by Cotton Division, FAS.

TABLE 3.--Cotton yarn production, USSR, and estimated cotton consumption 1939 and 1940, 1945-58

Calendar year	Yarn production ¹	Cotton consumed by mills ²	Calendar year	Yarn production ¹	Cotton consumed by mills ²
	1,000 metric tons	1,000 bales		1,000 metric tons	1,000 bales
1939.....	599	3,010	1951.....	799	3,940
1940.....	650	3,265	1952.....	838	4,190
1945.....	303	1,520	1953.....	899	4,430
1946.....	354	1,770	1954.....	971	4,770
1947.....	460	2,295	1955.....	1,038	5,105
1948.....	568	2,865	1956.....	972	4,800
1949.....	613	3,060	1957.....	1,016	5,015
1950.....	663	3,345	1958 ³	(1,040)	(5,200)

¹ Compiled from official sources.² Calculated from yarn production figures, allowing 7 to 9 percent net loss in waste, as specified in official reports.³ Preliminary.

TABLE 4.--Acreage of cotton, by Republics, USSR, 1940 and 1945, 1950-57

Republic	1940	1945	1950	1951	1952	1953	1954	1955	1956	1957
<u>Irrigated:</u>	1,000 acres	1,000 acres	1,000 acres	1,000 acres	1,000 acres					
Uzbekistan.....	2,282	1,866	2,713	2,743	2,793	2,848	3,312	3,256	3,223	3,328
Tadzhikistan...	262	232	311	340	359	360	381	400	407	413
Turkmenia.....	372	272	378	408	430	426	445	449	472	457
Azerbaidzhan...	465	240	374	418	451	484	489	495	498	492
Kazakhstan.....	251	168	240	280	285	278	278	283	272	259
Kirghizia.....	158	116	161	187	195	200	194	197	179	183
Armenia.....	40	33	42	42	44	44	46	46	40	37
Georgia.....	-	-	6	-	-	-	-	-	-	-
Total.....	3,830	2,927	4,225	4,418	4,557	4,640	5,145	5,126	5,091	5,169
<u>Nonirrigated:</u>										
Ukraine.....	698	15	687	1,200	1,300	-	271	269	13	-
RSFSR.....	602	53	805	1,107	1,143	(²)	25	13	-	-
Moldavia.....	-	-	7	-	-	-	-	24	-	-
Total.....	1,300	68	1,499	2,307	2,443	(²)	296	306	13	-
Grand Total.....	5,130	2,995	5,724	6,725	7,000	4,640	5,441	5,432	5,104	5,169

¹ Year beginning August 1.² Less than 500 acres.

Compiled by Cotton Division, FAS, from official sources.

TABLE 5.--Cotton ginnings by Republics, USSR, 1940 and 1945, 1950-57¹

Republic	1940	1945	1950	1951	1952	1953	1954	1955	1956	1957
<u>Irrigated:</u>	<u>1,000</u> <u>bales</u>									
Uzbekistan.....	2,445	976	2,943	3,681	3,840	3,836	3,910	4,398	4,642	4,267
Tadzhikistan...	280	104	327	449	513	615	637	640	(²)	616
Turkmenia.....	328	125	291	412	454	505	502	609	(²)	516
Azerbaidzhan...	267	81	298	422	373	438	570	595	(²)	577
Kazakhstan....	161	72	197	278	299	300	331	311	(²)	335
Kirghizia.....	128	53	141	196	202	225	215	157	(²)	219
Armenia.....	46	19	75	80	67	52	74	60	(²)	(60)
Georgia.....	-	-	8	-	-	-	-	-	-	-
Total.....	3,655	1,430	4,280	5,518	5,748	5,971	6,239	6,770	(²)	6,590
<u>Nonirrigated:</u>										
Ukraine.....	119	2	47	(85)	(92)	-	(46)	45	(²)	(²)
RSFSR.....	124	2	49	(67)	(70)	-	(20)	17	(²)	(²)
Moldavia.....	-	-	-	-	-	-	-	-	-	-
Total.....	243	4	96	(152)	(162)	-	(66)	62	(²)	(²)
Grand Total	3,898	1,434	4,376	5,670	5,910	5,971	6,305	6,832	³ 6,800	³ 6,650

¹ Calendar years.² Not available.³ Partly estimated.

Compiled from official sources by Cotton Division, FAS, or estimated on the basis of incomplete official figures.



